***New Phytologist* Supporting Information**

Article title: Tree height and leaf drought tolerance traits shape growth responses across droughts in a temperate broadleaf forest

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Table S1 Monthly Palmer Drought Severity Index (PDSI), and its rank among all years between 1950 and 2009 (driest=1), for focal droughts.

year	month	PDSI	rank
1966	May	-2.98	2
	June	-3.40	2
	July	-4.08	2
	August	-4.82	1
1977	May	-2.96	3
	June	-3.28	3
	July	-3.61	3
	August	-3.68	3
1999	May	-3.63	1
	June	-4.21	1
	July	-4.53	1
	August	-4.64	2

Table S2 Species-specific regression equations for bark thickness (mm) as a function of diameter at breast height without bark (mm).

Species	Equations	R^2
Carya cordiformis	$\ln[r_{bark}] = -1.56+0.416*\ln[DBH]$	0.226
Carya glabra	$\ln[r_{bark}] = -0.393+0.268*\ln[DBH]$	0.04
Carya ovalis	$\ln[r_{bark}] = -2.18+0.651*\ln[DBH]$	0.389
Carya tomentosa	$\ln[r_{bark}] = -0.477+0.301*\ln[DBH]$	0.297
Fagus grandifolia	-	-
Fraxinus americana	$\ln[r_{bark}] = 0.418+0.26*\ln[DBH]$	0.256
Juglans nigra	$\ln[r_{bark}] = 0.346+0.279*\ln[DBH]$	0.246
Liriodendron tulipifera	$\ln[r_{bark}] = -1.14+0.463*\ln[DBH]$	0.545
Quercus alba	$\ln[r_{bark}] = -2.09+0.637*\ln[DBH]$	0.603
Quercus prinus	$\ln[r_{bark}] = -1.31+0.528*\ln[DBH]$	0.577
Quercus rubra	$\ln[r_{bark}] = -0.593+0.292*\ln[DBH]$	0.101
all	$\ln[r_{bark}] = 0.245+0.219*\ln[DBH]$	0.087

We used linear regression on log-transformed data to relate r_{bark} to the diameter inside bark from 2008 data. These were then used to determine r_{bark} in the DBH_Y reconstruction (DBH in year Y). No bark correction was applied for *Fagus grandifolia*, which has thin bark.

Table S3 Species-specific regression equations for height (m) as a function of DBH (cm).

Species	Equations	R^2
Carya cordiformis	ln[H] = 0.332+0.808*ln[DBH]	0.874
Carya glabra	ln[H] = 0.685+0.691*ln[DBH]	0.841
Carya ovalis	ln[H] = 0.533+0.741*ln[DBH]	0.924
Carya tomentosa	ln[H] = 0.726+0.713*ln[DBH]	0.897
Fagus grandifolia	ln[H] = 0.708+0.662*ln[DBH]	0.857
Liriodendron tulipifera	ln[H] = 1.33+0.52*ln[DBH]	0.771
Quercus alba	ln[H] = 0.74+0.645*ln[DBH]	0.719
Quercus prinus	ln[H] = 0.41+0.757*ln[DBH]	0.886
Quercus rubra	ln[H] = 1.00+0.574*ln[DBH]	0.755
all	ln[H] = 0.839+0.642*ln[DBH]	0.857

Table S4 Individual tests of species traits as drivers of drought resistance, where *Rt* is used as the response variable.

		all droughts		1966		1977		1999	
variable	category	ΔAICc	coefficients	ΔAICc	coefficients	ΔAICc	coefficients	ΔAICc	coefficients
xylem porosity	R	-0.8	0.0630	2.29**	0.190	1.92	-0.152	3.36**	0.1500
	D/SR		0.0000		0.000		0.000		0.0000
PLA		6.7**	-0.0140	9.13**	-0.025	-0.32	-0.010	-0.95	-0.0070
LMA		-2.01	0.0002	-1.9	0.001	-1.68	-0.002	-2.03	0.0003
π_{tlp}		1.33	-0.1740	-1.65	-0.107	1.23	-0.245	-0.1	-0.1690
WD		-1.97	-0.0310	-1.26	-0.206	-1.44	-0.154	0.66	0.2720

Variable abbreviations are as in Table 2. ΔAICc is the AICc of a model excluding the trait minus that of the model including it.

**ΔAICc > 2: variable considered significant as an individual predictor

Table S5 Individual tests of species traits as drivers of drought resistance, where Rt_{ARIMA} is used as the response variable.

		all droughts		1966		1977		1999	
variable	category	ΔAICc	coefficients	ΔAICc	coefficients	ΔAICc	coefficients	ΔAICc	coefficients
xylem porosity	R	-1.47	0.0420	0.95	0.1520	2.84**	-0.171	2.27**	0.155
	D/SR		0.0000		0.0000		0.000		0.000
PLA		4.48**	-0.0120	10.15**	-0.0240	-0.9	-0.008	-1.67	-0.005
LMA		-1.99	-0.0003	-2.02	0.0005	-0.42	-0.003	-1.9	0.001
π_{tlp}		0.42	-0.1510	-1.94	-0.0530	-0.53	-0.179	0.04	-0.200
WD		-1.94	-0.0390	-0.08	-0.3040	-1.57	-0.142	0.83	0.316

Variable abbreviations are as in Table 2. ΔAICc is the AICc of a model excluding the trait minus that of the model including it.

**ΔAICc > 2: variable considered significant as an individual predictor

Table S6 Individual test of species traits as drivers of drought recovery (*Rc*).

		all droughts		1966		1977		1999	
variable	category	ΔAICc	coefficients	ΔAICc	coefficients	ΔAICc	coefficients	ΔAICc	coefficients
xylem porosity	R	15.25**	-0.280	9.9**	-0.474	-1.67	-0.0370	17.06**	-0.3380
	D/SR		0.000		0.000		0.0000		0.0000
PLA		-1.98	0.002	-1.33	0.014	1.10	-0.0090	-2.03	0.0010
LMA		-1.35	-0.002	0.32	-0.008	-2.04	-0.0001	-2.03	-0.0005
π_{tlp}		-1.13	-0.149	-1.94	-0.101	1.08	-0.1630	-1.14	-0.2020
WD		-1.86	-0.088	-1.6	0.278	-1.68	-0.0980	-1.03	-0.2950

Variable abbreviations are as in Table 2. ΔAICc is the AICc of a model excluding the trait minus that of the model including it.

**ΔAICc > 2: variable considered significant as an individual predictor

Table S7 Individual test of species traits as drivers of drought resilience (*Rs*).

		all droughts		1966		1977		1999	
variable	category	ΔAICc	coefficients	ΔAICc	coefficients	ΔAICc	coefficients	ΔAICc	coefficients
xylem porosity	R	0.24	-0.147	-1.29	-0.110	1.42	-0.263	-1.11	-0.0840
	D/SR		0.000		0.000		0.000		0.0000
PLA		1.09	-0.016	1.09	-0.020	-0.51	-0.017	0.67	-0.0130
LMA		-1.9	-0.001	-1.00	-0.004	-1.95	-0.001	-2.02	-0.0004
π_{tlp}		2.5**	-0.347	-1.11	-0.212	1.57	-0.468	6.11**	-0.3730
WD		-1.83	-0.109	-2.05	-0.020	-1.37	-0.298	-2.02	0.0360

Variable abbreviations are as in Table 2. ΔAICc is the AICc of a model excluding the trait minus that of the model including it.

**ΔAICc > 2: variable considered significant as an individual predictor

Table S8 Summary of top full models for each drought instance, where *Rt* is used as the response variable.

drought	ΔAICc	*Marginal* R^2	*Conditional* R^2	Intercept	$ln[H]$	$ln[TWI]$	$ln[H] * ln[TWI]$	*PLA*	π_{tlp}
all	**0.000**	**0.08**	**0.12**	**1.131**	**-0.057**	**-0.086**	**-**	**-0.012**	**-0.113**
	0.583	0.06	0.11	1.423	-0.055	-0.086	-	-0.013	-
	0.726	0.08	0.12	1.537	-0.202	-0.326	0.082	-0.012	-0.114
	1.352	0.06	0.11	1.826	-0.198	-0.324	0.081	-0.013	-
1966	**0.000**	**0.16**	**0.25**	**1.622**	**-0.135**	**-**	**-**	**-0.025**	**-**
1977	**0.000**	**0.06**	**0.22**	**0.503**	**-**	**-0.144**	**-**	**-**	**-0.24**
	0.908	0.01	0.21	1.069	-	-0.144	-	-	-
	0.988	0.06	0.22	0.568	-0.03	-0.139	-	-	-0.246
	1.144	0.08	0.24	0.684	-	-0.142	-	-0.007	-0.204
	1.267	0.04	0.22	1.211	-	-0.141	-	- 0.01	-
1999	**0.000**	**0.01**	**0.18**	**1.061**	**-**	**-0.102**	**-**	**-**	**-**
	0.023	0.04	0.19	0.659	-	-0.101	-	-	-0.169
	0.954	0.02	0.19	1.157	-	-0.1	-	-0.007	-
	1.513	0.05	0.21	0.783	-	-0.1	-	-0.005	-0.145
	1.803	0.01	0.18	1.024	0.013	-0.103	-	-	-
	1.901	0.04	0.19	0.635	0.011	-0.102	-	-	-0.166

Models are ranked by AICc. Shown are all models whose AICc value falls within 2.0 (ΔAICc<1) of the best model (bold). R^2 refers to conditional R^2. Year was included in the model for all drought years, but its effect was not included in any top models, and coefficients were small (1966: 0, 1977: -0.019, 1999: -0.005; same values in all top models).

Table S9 Summary of top full models for each drought instance, where Rt_{ARIMA} is used as the response variable.

drought	ΔAICc	*Marginal* R^2	*Conditional* R^2	Intercept	*ln*[*H*]	*ln*[*TWI*]	$ln[H] * ln[TWI]$	*PLA*	π_{tlp}
all	**0.000**	**0.05**	**0.09**	**2.113**	**-0.307**	**-0.506**	**0.14**	**-0.012**	**-**
	0.419	0.06	0.10	1.872	-0.31	-0.508	0.141	-0.011	-0.096
	1.217	0.05	0.09	1.395	-0.06	-0.1	-	-0.012	-
	1.698	0.06	0.10	1.153	-0.062	-0.1	-	-0.011	-0.095
1966	**0.000**	**0.17**	**0.23**	**1.660**	**-0.154**	**-**	**-**	**-0.024**	**-**
	1.393	0.17	0.23	1.735	-0.152	-0.047	-	-0.024	-
	1.457	0.16	0.23	1.859	-0.152	-	-	-0.025	0.078
1977	**0.000**	**0.01**	**0.16**	**1.130**	**-**	**-0.18**	**-**	**-**	**-**
	0.424	0.02	0.16	2.453	-0.461	-0.896	0.25	-	-
	0.688	0.03	0.17	0.720	-	-0.179	-	-	-0.173
	0.922	0.04	0.17	2.040	-0.466	-0.898	0.251	-	-0.18
	0.927	0.03	0.17	1.248	-	-0.177	-	-0.008	-
	1.322	0.03	0.17	2.569	-0.461	-0.893	0.25	-0.008	-
	1.709	0.01	0.15	1.183	-0.02	-0.177	-	-	-
1999	**0.000**	**0.04**	**0.20**	**0.563**	**-**	**-0.076**	**-**	**-**	**-0.2**
	0.064	0.03	0.19	0.421	-	-	-	-	-0.202
	0.127	0.00	0.18	1.036	-	-0.077	-	-	-
	0.256	0.00	0.18	0.899	-	-	-	-	-
	1.777	0.04	0.20	0.529	0.016	-0.078	-	-	-0.195
	1.797	0.01	0.20	1.101	-	-0.076	-	-0.004	-
	1.815	0.00	0.18	0.986	0.018	-0.079	-	-	-
	1.838	0.01	0.20	0.972	-	-	-	-0.005	-
	1.933	0.03	0.19	0.391	0.012	-	-	-	-0.199
	1.979	0.04	0.21	0.612	-	-0.075	-	-0.002	-0.19
	1.999	0.04	0.21	0.482	-	-	-	-0.002	-0.19

Models are ranked by AICc. Shown are all models whose AICc value falls within 2.0 (ΔAICc<1) of the best model (bold). R^2 refers to conditional R^2. Year was included in the model for all drought years and appeared in all its top models, but coefficients were small (1966: 0, 1977: -0.03, 1999: 0.008; same values in all top models).

Table S10 Summary of top full models for each drought instance, where *Rc* is used as the response variable.

drought	ΔAICc	*Marginal* R^2	*Conditional* R^2	Intercept	$ln[H]$	$ln[TWI]$	$ln[H] * ln[TWI]$	*PLA*	π_{tlp}
all	**0.000**	**0.05**	**0.17**	**0.434**	**0.345**	**0.844**	**-0.269**	**-**	**-**
	0.995	0.05	0.17	1.913	-0.126	-	-	-	-
	1.135	0.06	0.17	0.077	0.344	0.845	-0.269	-	-0.152
	1.991	0.05	0.18	0.410	0.346	0.843	-0.269	0.002	-
1966	**0.000**	**0.01**	**0.28**	**-0.797**	**0.89**	**1.263**	**-0.475**	**-**	**-**
	1.040	0.00	0.25	1.577	-	-	-	-	-
	1.367	0.02	0.30	-0.984	0.888	1.257	-0.474	0.013	-
	1.785	0.00	0.26	1.781	-	-0.114	-	-	-
	1.956	0.01	0.30	-1.025	0.89	1.261	-0.475	-	-0.097
1977	**0.000**	**0.17**	**0.17**	**2.485**	**-0.482**	**-**	**-**	**-**	**-0.157**
	0.299	0.17	0.17	2.943	-0.47	-	-	-0.008	-
	0.716	0.17	0.18	2.657	-0.477	-	-	-0.006	-0.114
	0.807	0.17	0.18	1.152	0.071	1.026	-0.308	-0.009	-
	0.875	0.17	0.18	2.729	-0.47	0.124	-	-0.009	-
	0.891	0.17	0.18	2.271	-0.479	0.115	-	-	-0.158
	0.910	0.17	0.18	0.712	0.054	1.004	-0.304	-	-0.159
	1.315	0.17	0.18	0.871	0.065	1.023	-0.308	-0.006	-0.112
	1.331	0.16	0.17	2.805	-0.464	-	-	-	-
	1.372	0.17	0.18	2.445	-0.475	0.122	-	-0.006	-0.112
	1.974	0.16	0.17	2.597	-0.466	0.118	-	-	-
1999	**0.000**	**0.00**	**0.16**	**1.281**	**-**	**-**	**-**	**-**	**-**
	0.532	0.00	0.17	1.093	-	0.105	-	-	-
	1.091	0.02	0.19	0.779	-	-	-	-	-0.212
	1.609	0.02	0.19	0.578	-	0.106	-	-	-0.217
	1.755	0.00	0.17	1.200	0.027	-	-	-	-
	1.996	0.00	0.18	1.251	-	-	-	0.002	-

Models are ranked by AICc. Shown are all models whose AICc value falls within 2.0 (ΔAICc<1) of the best model (bold). R^2 refers to conditional R^2. Year was included in the model for all drought years and appeared in all its top models (1966: 0, 1977: -0.14, 1999: -0.217; same values in all top models).

Table S11 Summary of top full models for each drought instance, where *Rs* is used as the response variable.

drought	ΔAICc	*Marginal* R^2	*Conditional* R^2	Intercept	$ln[H]$	$ln[TWI]$	$ln[H] * ln[TWI]$	*PLA*	π_{tlp}
all	**0.000**	**0.10**	**0.17**	**-0.265**	**0.348**	**0.864**	**-0.291**	**-0.012**	**-0.287**
	0.176	0.08	0.16	-0.572	0.347	0.859	-0.291	-	-0.347
	1.518	0.07	0.16	0.458	0.354	0.866	-0.292	-0.016	-
	1.552	0.09	0.17	1.253	-0.166	-	-	-0.011	-0.288
	1.698	0.08	0.16	0.940	-0.166	-	-	-	-0.348
1966	**0.000**	**0.04**	**0.15**	**1.834**	**-0.085**	**-**	**-**	**-0.02**	**-**
	0.402	0.03	0.16	1.589	-	-	-	-0.02	-
	1.189	0.00	0.14	1.534	-0.082	-	-	-	-
	1.313	0.00	0.15	1.293	-	-	-	-	-
	1.692	0.04	0.16	1.534	-0.085	-	-	-0.018	-0.116
1977	**0.000**	**0.14**	**0.28**	**-0.932**	**0.294**	**1.207**	**-0.384**	**-**	**-0.467**
	0.497	0.13	0.28	1.194	-0.383	-	-	-	-0.469
	1.304	0.15	0.30	-0.648	0.294	1.208	-0.383	-0.011	-0.411
	1.542	0.13	0.28	1.026	-0.387	0.095	-	-	-0.472
	1.555	0.09	0.28	0.138	0.304	1.211	-0.385	-	-
	1.852	0.14	0.29	1.467	-0.381	-	-	-0.01	-0.416
1999	**0.000**	**0.07**	**0.13**	**0.237**	**-**	**-**	**-**	**-**	**-0.366**
	0.313	0.08	0.14	0.472	-	-	-	-0.008	-0.317
	0.503	0.07	0.13	0.358	-0.048	-	-	-	-0.376
	0.532	0.07	0.13	0.394	-	-0.086	-	-	-0.364
	0.726	0.09	0.14	0.588	-0.047	-	-	-0.008	-0.328
	1.079	0.09	0.15	0.602	-	-0.081	-	-0.008	-0.319
	1.249	0.07	0.13	0.495	-0.044	-0.08	-	-	-0.374
	1.706	0.09	0.14	0.699	-0.044	-0.075	-	-0.007	-0.329

Models are ranked by AICc. Shown are all models whose AICc value falls within 2.0 (ΔAICc<1) of the best model (bold). R^2 refers to conditional R^2. Year was included in the model for all drought years and appeared in all its top models (1966: 0, 1977: -0.099, -0.099, -0.099, -0.097, -0.097; 1999: -0.174, -0.174, -0.174, -0.173, -0.172).

Fig. S1 Time series of Palmer Drought Severity Index (PDSI) for each focal drought year.

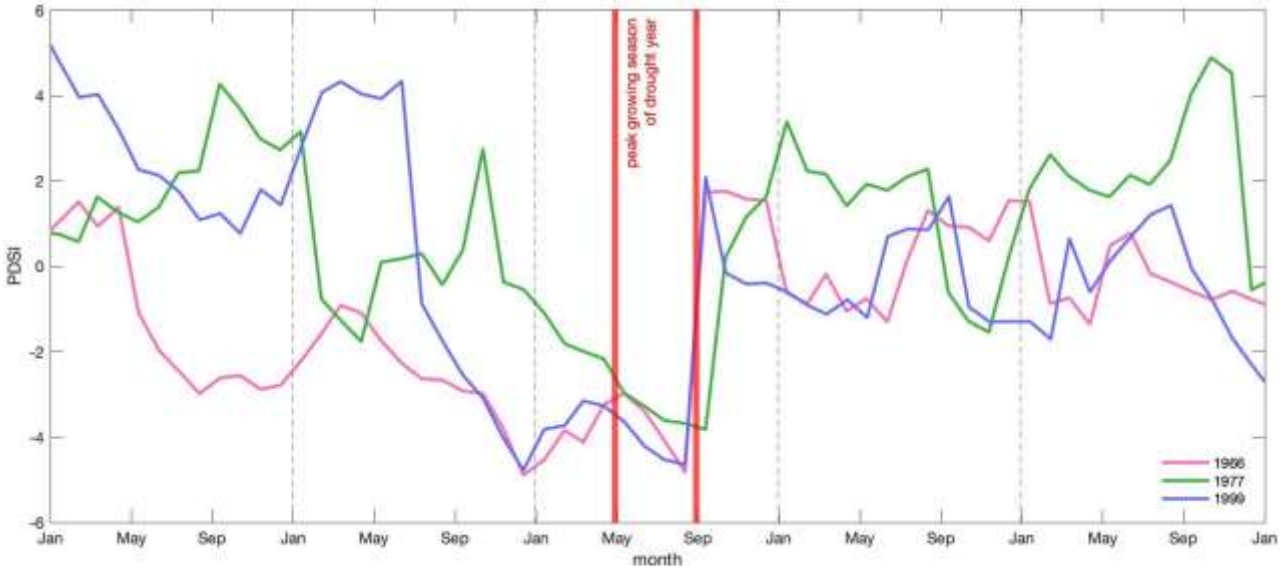


Fig. S2 Map of ForestGEO plot showing topographic wetness index and location of cored trees. Scale units are in meters.

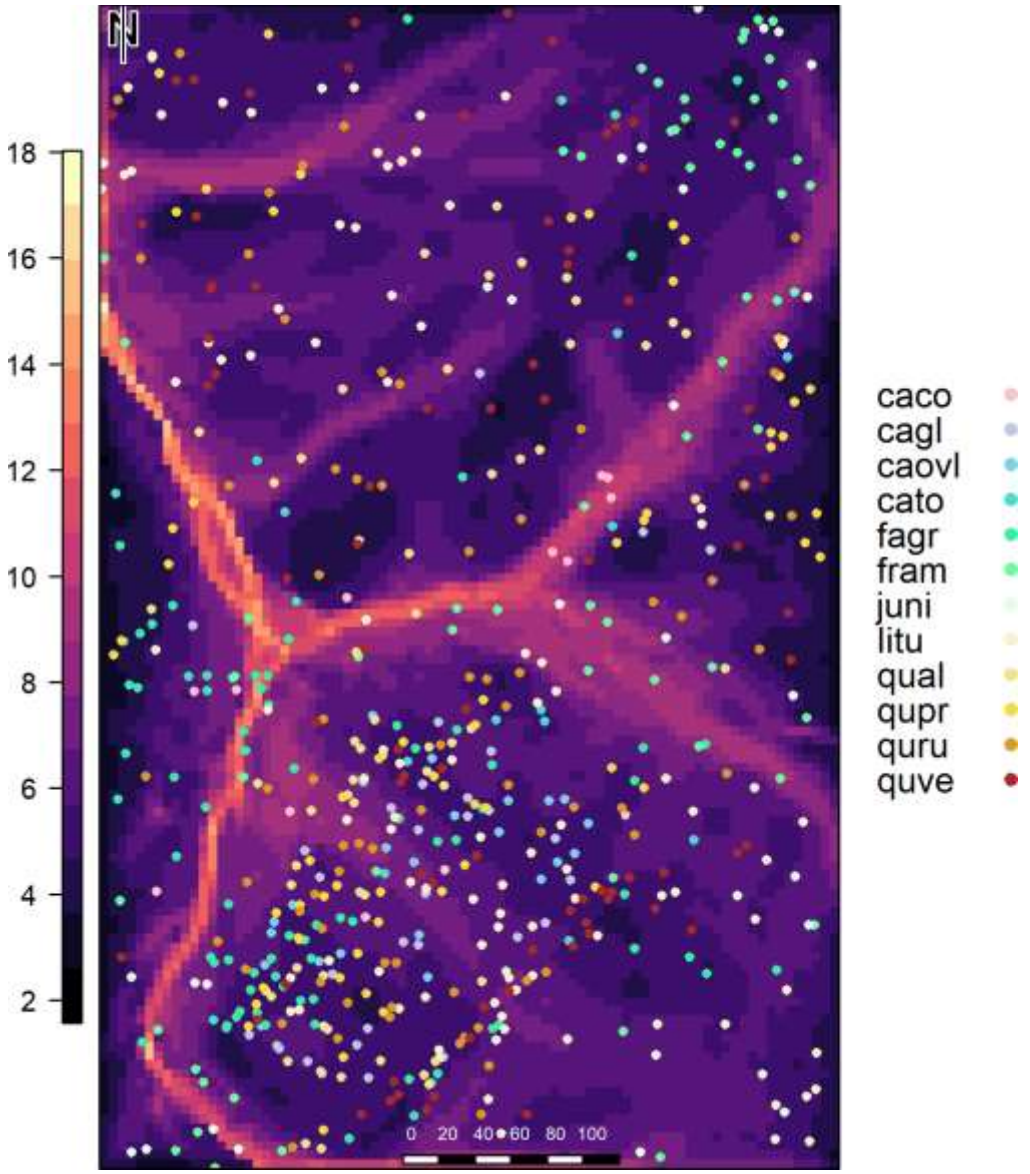


Fig. S3 Distribution of reconstructed tree heights across drought years.

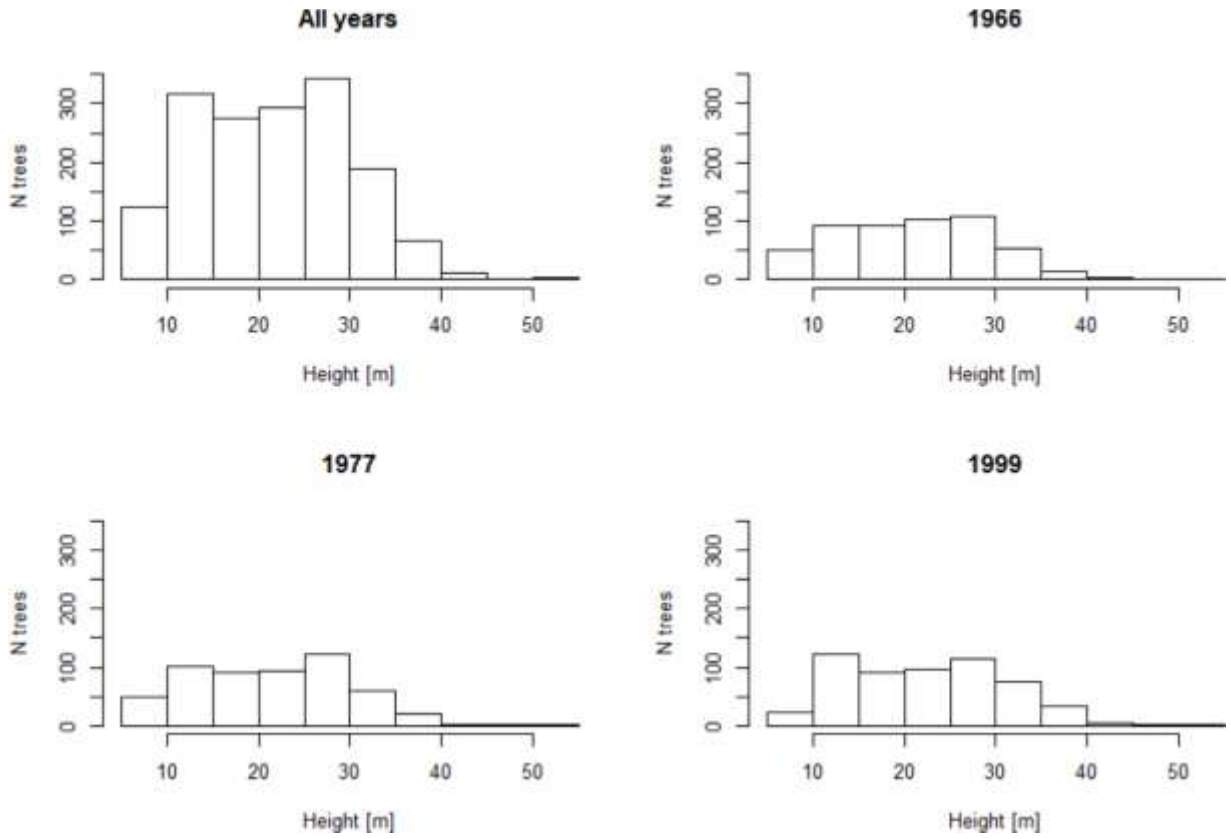


Fig. S4 Distribution of independent variable values by species. Species codes are given in Table 2. Boxes in plots (a) – (f) represent the interquartile range, with the horizontal line at the median, whiskers representing the range within 2.7 SD, and dots representing outliers. For plots (a) – (f), species that are assigned the same letter are not significantly different from each other with regard to the tested variable. Similarly, letter groupings do not transfer between variables. Meanwhile, plot (g) shows the number of trees in each crown position per species. Descriptions of variables (e.g. $ln[H]$) can be found in Table 3.

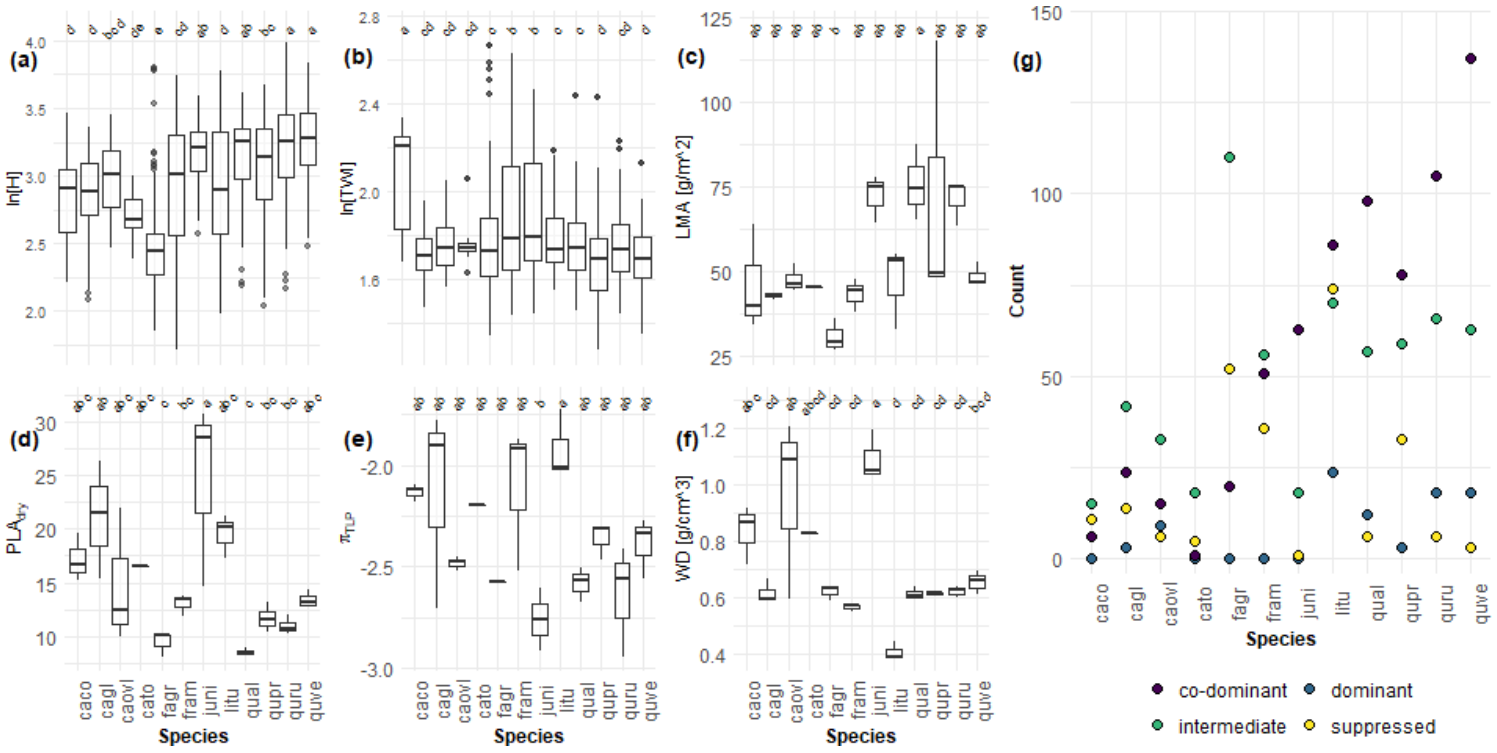


Fig. S5 Comparisons of *Rt* and Rt_{ARIMA} results, with residuals, for each drought scenario.

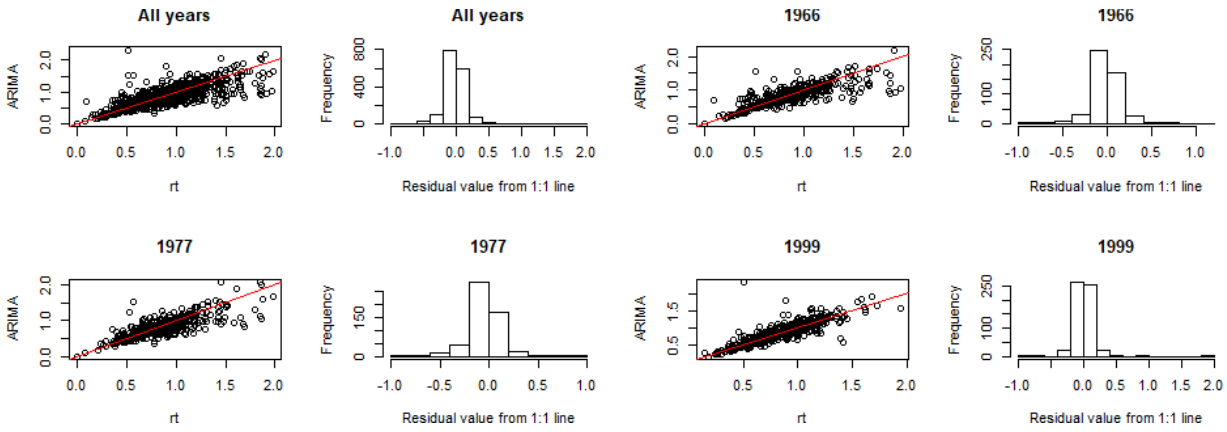


Fig. S6 Density plot of drought recovery (*Rc*) for each focal drought year.

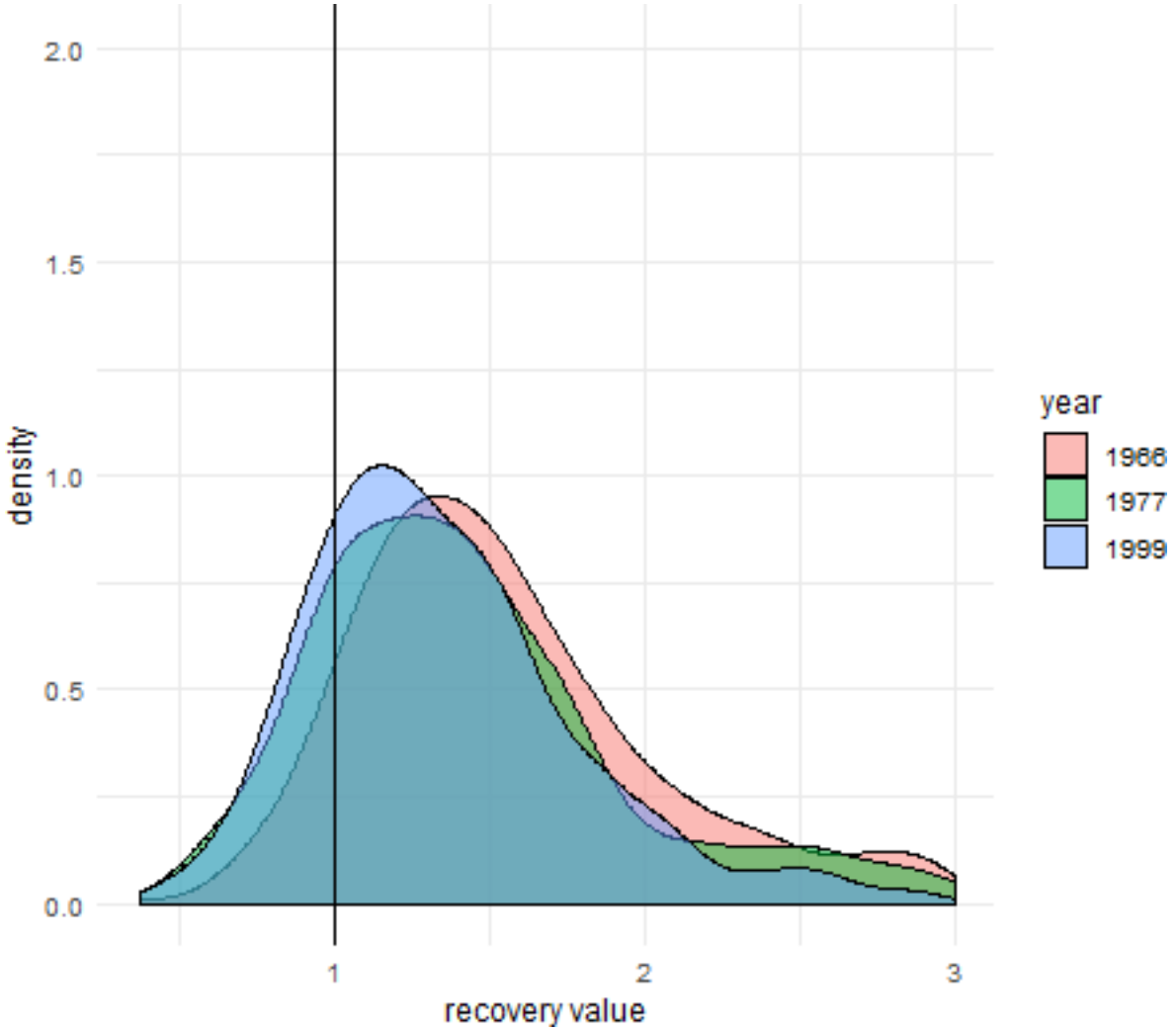
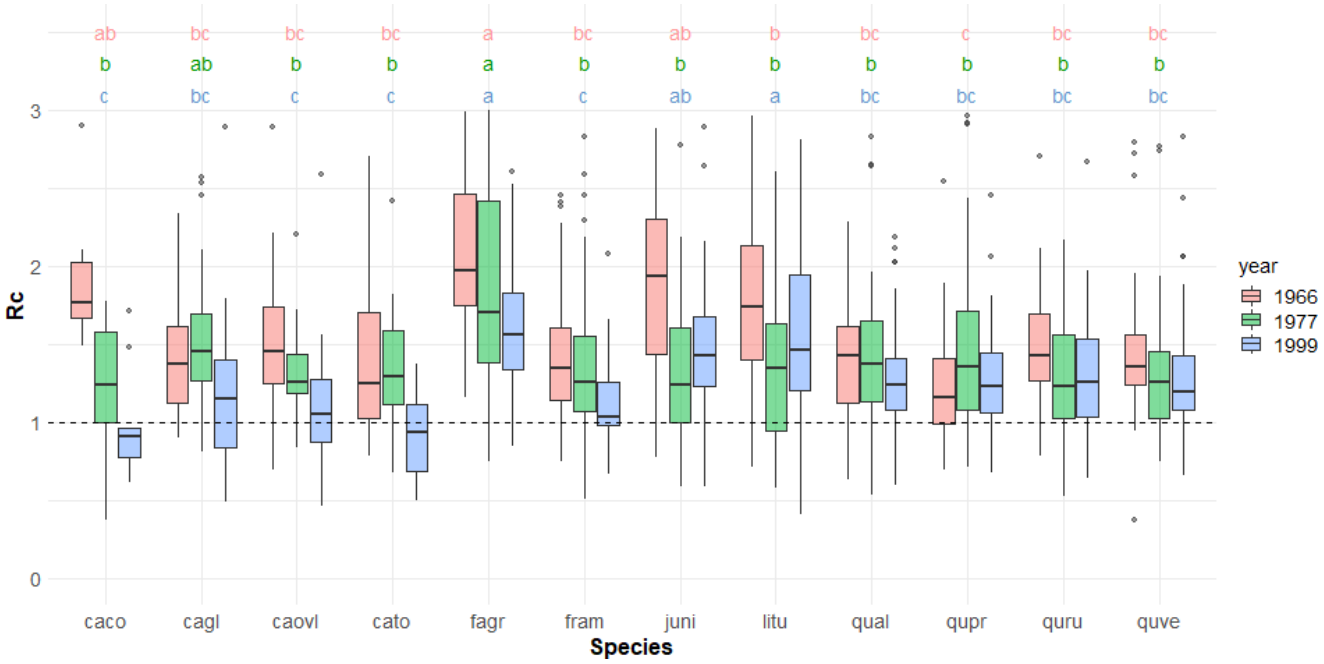


Fig. S7 Drought recovery (*Rc*) across species for the three focal droughts. Species codes are given in Table 2. Shaded boxes represent the interquartile range, with horizontal line at median, whiskers represent the range within 2.7 SD, and dots represent outliers. The dotted line at y=1 represents no change in *Rc* from the five years prior to drought. Letters illustrate significance groupings per year (colored and ordered, top to bottom, 1966, 1977, 1999). That is, a group of species with the same letter above their boxplot (e.g. "b") are statistically different from species in another group (e.g. "a"). See Fig. 4 for parallel plot for resistance (*Rt*) and resilience (*Rs*). Analysis conducted using *agricolae* package in R.



Methods S1 Further Package Citations

While there were several R-packages we used for a specific purpose in our methods, numerous packages were immensely helpful for this research behind the scenes. As in all of science, this study is a representation of the work done by both the authors of this paper as well as countless others. While acknowledging everyone is impossible, we want to at least give thanks to those who made this work possible.

R-packages not already cited in the main manuscript include the following, listed alphabetically by corresponding package name:

R base (R Core Team, 2019); broom (Robinson & Hayes, 2020); car (Fox *et al.*, 2019); cowplot (Wilke, 2019); data.table (Dowle & Srinivasan, 2019); devtools (Wickham *et al.*, 2020b); dplR (Bunn *et al.*, 2019); dplyr (Wickham *et al.*, 2020a); extrafont (Winston Chang, 2014); ggplot2 (Wickham *et al.*, 2019); ggpubr (Kassambara, 2020); ggthemes (Arnold, 2019); gridExtra (Auguie, 2017); knitr (Xie, 2020); lubridate (Spinu *et al.*, 2018); MuMIn (Barton, 2019); piecewiseSEM (Lefcheck *et al.*, 2019); png (Urbanek, 2013); purrr (Henry & Wickham, 2019); raster (Hijmans, 2020); rasterVis (Perpinan Lamigueiro & Hijmans, 2019); RCurl (Temple Lang, 2020); readxl (Wickham & Bryan, 2019); reshape2 (Wickham, 2017); rgdal (Bivand *et al.*, 2019); rgeos (Bivand & Rundel, 2019); rmarkdown (Allaire *et al.*, 2020); sf (Pebesma, 2020); stringi (Gagolewski *et al.*, 2020); stringr (Wickham, 2019); tidyr (Wickham & Henry, 2020)

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